OPV Morphology and Charge Carrier Dynamics: Towards Thicker Devices (PV-2)

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Scientific Achievement:

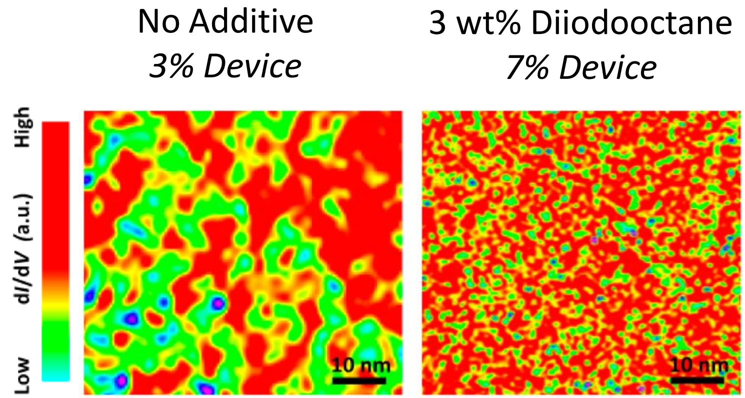
We employ a powerful new combination of techniques (scanning tunneling microscopy and time-resolved microwave conductivity) to understand how organic photovoltaic (OPV) active-layer morphology influences device performance metrics.

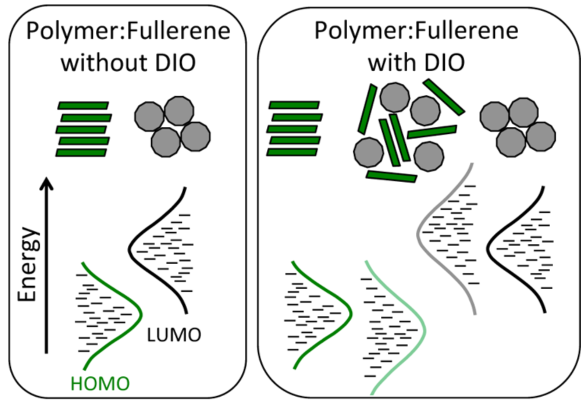
Significance and Impact:

This combination of techniques will aid in developing OPV morphologies with longer-lived charge carriers that will, in turn, be more amenable to thick active layers and large-scale processing.

Research Details:

- Charge-carrier dynamics and device metrics of high-performance PCE10 Polymer: $PC_{70}BM$ fullerene blends measured at NREL
- Imaging of blends and their density of states measured at IISc
- Performance metrics correlated with morphology
- Certain characteristics of morphologies can now be targeted to enhance life of charge carriers, which would allow the use of thicker active layers more amenable to roll-to-roll processing





DOS Broadening Enhances Photocurrent

(Top): STM dI/dV images of PCE10 polymer:$PC_{70}BM$ fullerene blends. DIO additive significantly reduces domains size. Green and red regions correspond to PCE10-rich and PC70BM-rich domains, respectively. (Bottom): Illustration of how DIO broadens the density of states.

Publication: L.E. Garner, A. Bera, B.W. Larson, D.P. Ostrowski, A.J. Pal, and W.A. Braunecker, Promoting Morphology with a favorable density of states using diiodooctane to improve organic photovoltaic device efficiency and charge carrier lifetimes, *ACS Energy Letters* **2,** 1556 (2017). **DOI:** 10.1021/acsenergylett.7b00315

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